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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Preparing Activity: KSC

NASA/KSC-27 05 26.00 98 (April 2006)

Superseding
NASA/KSC-16064 (July 2005)

References are NOT in agreement with UMRL dated 01 April 2006

Revised throughout - changes not indicated by CHG tags
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DIVISION 27 - COMMUNICATIONS

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GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

04/06

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SECTION 27 05 26.00 98

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
04/06

****
NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers electrical system and equipment grounding including ground rods, grounding conductors, connectors, and other accessories for small jobs. The section excludes instrumentation and static grounding systems.

Drawings should show plan layout of each grounding electrode, ground mat, ground grid, substation ground bus, interconnecting grounding conductor, and tap connections to steel building columns and outdoor electrical equipment. Detail drawings of ground mats and ground grids should show configuration, ground rod spacings, interconnecting cable and tap connections to substation yard fence, substation ground bus, and interior equipment.

If grounding systems as shown fail to achieve the desired measured resistance to ground, additional ground rods may be required.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 8	(2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

JOHN F. KENNEDY SPACE CENTER (KSC)

KSC-SPEC-Z-0005	(Am 2; 1975) Brazing, Steel, Copper, Aluminum, Nickel, and Magnesium Alloys
KSC-STD-E-0012	(Rev A; 1974; Am 1; 1978) Bonding and Grounding

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

U.S. AIR FORCE TECHNICAL ORDERS (TO)

TO 31W3-10-15	(1980; CHG 3 1982) Outside Plant Cable Testing

UNDERWRITERS LABORATORIES (UL)

UL 467	(2004) Standard for Grounding and Bonding Equipment

1.2 GENERAL REQUIREMENTS

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NOTE: If section 26 00 00.00 40 GENERAL ELECTRICAL PROVISIONS is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.

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Section 26 00 00.00 40 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Ground Rods
Ground and Bond Wires
Grounding and Bonding Connectors
Grounding and Bonding Fasteners

PART 2 PRODUCTS

2.1 GROUND AND BOND WIRES

Ground and bond wires shall be in accordance with ASTM B 8 and shall be annealed bare copper, Class "B" stranded, with 98 percent conductivity.

Size of wires shall be in accordance with the requirements of NFPA 70.

2.2 GROUNDING AND BONDING CONNECTORS

Grounding and bonding connectors shall conform to the requirements of UL 467.

2.3 GROUNDING AND BONDING FASTENERS

All bolts, nuts, washers, lock washers, and associated fasteners used for grounding and bonding connections shall be [copper] [bronze] [tin plated tempered brass].

2.4 GROUND RODS

Grounds shall be 20 millimeter diameter by 6100 millimeter 3/4 inch by 20 feet copper clad steel rods in accordance with KSC-STD-E-0012.

PART 3 EXECUTION

3.1 GENERAL

Bonding and grounding requirements, as a minimum, shall be those specified by NFPA 70.

3.2 BONDING

3.2.1 Types of Bonds

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NOTE: Choose from one of the bond types or a combination of bond types listed below.
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Unless otherwise specified herein, bonding of metal surfaces shall be accomplished by [brazing] [welding] [clamping] [structural joining methods] [a combination thereof].

3.2.1.1 Brazing

Brazing solder shall conform to KSC-SPEC-Z-0005.

3.2.1.2 Welding

Welding shall be by the exothermic process. Welding procedure shall include the proper mold and powder charge and shall conform to the manufacturer's recommendation.

3.2.1.3 Clamping

In external locations, clamping shall be used only where a disconnect type of connection is required. Connection device may utilize either spring-loaded jaws or threaded fasteners. Device shall be so constructed that positive contact pressure is maintained at all times. This method includes the use of machine bolts with tooth type or spring type lock washers.

3.2.2 Cleaning of Bonding Surfaces

All surfaces which comprise the bond shall be thoroughly cleaned before

joining to remove paint, oxides, and other resistance films from the mating surfaces. Gentle and uniform pressure along with an appropriate abrasive shall be used to ensure a smooth, uniform surface without "point contacts." Excessive metal shall not be removed from the surface. Clad metals shall be cleaned with a fine steel wool or grit in such a manner that the cladding material is not penetrated by the cleaning process. Bare metal shall then be cleaned with solvent-moistened cheesecloth. Grease, oil, dirt, corrosive preventatives, and other contaminants shall also be removed using this same method. This cleaned area shall be allowed to air dry before making bond. Bond shall be attached within 1 hour after cleaning. Joint shall be sealed and the exposed surfaces refinished within 2 hours to prevent oxidation. If additional time is required, a corrosion-preventative compound shall be applied until the area can be refinished.

3.2.3 Bond Resistance

Resistance of any bond shall be tested in accordance with TO 31W3-10-15. Bonds that fail to successfully comply to test parameters shall be reworked by the Contractor at no additional cost to the Government.

3.2.4 Enclosure Bonding

All new FOT cabinets shall be bonded to ground. At least one copper connection shall be made from the system ground point to one or more enclosures in the area such that all enclosures and equipment when properly bonded together provide a low impedance path to ground.

3.2.5 Cable Tray Bonding

Cable tray sections shall be bonded together. Cable tray sections in tandem assembly shall be considered as having electrical continuity when these sections are bonded with appropriate high strength bolts. Whenever expansion joints are required, a jumper consisting of a bond strap shall be installed. Trays shall be grounded to the building ground system.

3.2.6 Bonding of Conduit and Raceway Systems

Metal conduit, fittings, junction boxes, outlet boxes, armored and metal sheathed cable, and other raceways shall be bonded as listed below. Care shall be taken to ensure adequate electrical contact at the joints and terminations.

3.2.7 Rigid Metal Conduit and Terminations

All threaded connections must be [cleaned and coated with conductive epoxy] [welded as specified herein] and be wrench tight. All exposed threads shall be painted. Conduits entering boxes and enclosures shall be [welded] [conductive epoxy coated and bonded to the box with bonding type locknuts (one outside and one inside)] [locknut and grounding type bushing]. Locknuts that gouge into the metal box when tightened are acceptable.

3.2.8 Protection of Finished Bonds

Finished bonds shall be protected by painting to match the original finish after bond is made.

3.2.9 Splice Bonds

Cable with over all shields shall have the shield continuity maintained through each splice. Bond clamp shall have perforating teeth to penetrate the cable's metallic shield and be connected across the splice with the equivalent of a 4.1 millimeter diameter (No. 6 AWG) No. 6 AWG copper conductor.

3.3 GROUNDING CONNECTIONS

All ground connections shall be bonded connections in accordance with paragraph entitled, "Bonding."

All ground connections that are buried or in inaccessible locations shall be welded. The process shall join all strands and shall not in any way cause the parts to be damaged or weakened.

3.4 PLACING GROUND RODS

Ground rods shall be installed and tested in accordance with KSC-STD-E-0012.

-- End of Section --